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|---------------------------|-------------------------|-----------------|---|
| <b>Academic Year</b>      | 2018/9                  | <b>Semester</b> | 2 |
| <b>Course Coordinator</b> | Roderick Bates          |                 |   |
| <b>Course Code</b>        | CM5012                  |                 |   |
| <b>Course Title</b>       | Forensic Science        |                 |   |
| <b>Pre-requisites</b>     | none                    |                 |   |
| <b>Mutually Exclusive</b> | CM5002 Forensic Science |                 |   |
| <b>No of AUs</b>          | 2                       |                 |   |
| <b>Contact Hours</b>      | online activities       | 26 hours        |   |
| <b>Proposal Date</b>      | 22 October 2018         |                 |   |

### Course Aims

On completing this course, you will understand and appreciate how basic science can be applied to the solution of criminal cases. You will understand the basic chemistry, physics and biology behind forensic science and see how this knowledge can be applied. You will understand how forensic science fits into the legal system alongside other forms of police work. You will appreciate not only what forensic science can do, but also what is beyond its scope i.e. the limits of forensic science.

### Intended Learning Outcomes (ILO)

By the end of this course, you (as a student) would be able to:

1. explain the principles and scope of forensic science and the concept of individualisation
2. describe how the techniques of chemical analysis can be used in forensic science and interpret simplified chromatograms and spectra.
3. describe the various *post mortem* processes of the human body, and be able to apply them in estimation of the time of death
4. describe the nature of blood, and apply that knowledge in the analysis of crime scene blood spatter
5. describe the main principles of toxicology, and to use LO2 in this context
6. describe the DNA molecule and how it is inherited; to interpret simplified forensic profiles using the STR method; to describe the limits of forensic DNA profiling
7. describe the main types of illegal drugs and be able to distinguish between natural, semi-synthetic and synthetic drugs, and to use LO2 for their analysis
8. describe the chemistry and morphology of polymers and fibres (including hair) and to explain to what extent this information can be used forensically
9. describe the limitations of the three principles of fingerprinting; to be able to compare fingerprinting with DNA methods
10. describe how different kinds of forensic evidence arise during the firing of a gun
11. critically combine some or all of the learning outcomes 1-10 above in the analysis of a given crime scene

### Course Content

Introduction to Forensic Science: an overview of the subject, how forensic science developed and how it works within the legal system.

Atomic spectroscopy: how the analysis of the elemental composition of a sample can yield information.

Molecular spectroscopy: determination of the compounds present in a sample by chromatographic and spectroscopic means.

Determination of the time of death: how this can be determined by chemical, biological and circumstantial means.

Blood: the composition of blood, how blood can be analysed and identified; blood spatter analysis.

Drugs: an overview of the main types of drugs, their source and chemical structures.

Toxicology: the Chemistry behind poisoning, including organic, inorganic and biological poisons and notable poisoning cases.

DNA: the basic concepts of DNA and how it is inherited; forensic DNA profiling including the use of the STR method.

Fingerprinting: how fingerprinting, one of the earliest forensic methods, developed as a means of identification; the three principles of fingerprinting; methods to visualise fingerprints.

Firearms: internal ballistics, including methods to individualise firearm evidence and the analysis of gun shot residue.

Polymers and fibres: the role of fibre and hair evidence in forensic science, including the identification of fibres by chemical means and by microscopy.

Case studies: discussion of a range of cases that illustrate important concepts or failings, or are landmarks in the subject.

### Assessment (includes both continuous and summative assessment)

| Component     | Course LO Tested | Related Programme LO or Graduate Attributes | Weighting | Team/Individual | Assessment Rubrics |
|---------------|------------------|---|-----------|-----------------|--------------------|
| case study 1  | 1-5, 11          | competence and creativity                   | 20        | individual      | see appendix 1     |
| peer review 1 | 1-5, 11          |   | 20        | individual      |                    |
| case study 2  | 1-11             |   | 30        | individual      |                    |
| peer review 2 | 1-11             |   | 30        | individual      |                    |
| Total         |                  |   | 100%      |                 |                    |

Note: (1) this course is pass/fail graded.

Note (2) Regardless of marks, passing is only possible if the required number of activities is completed.

### Formative feedback

You will be given feedback in three ways:

1. By response to postings on the course discussion board.
2. Peer feedback on the case studies.

### Learning and Teaching approach

| Approach        | How does this approach support students in achieving the learning outcomes?  |
|-----------------|--|
| Online lectures | The content will be delivered online. This allows (a) extensive use of animations and laboratory videos and (b) use of interactive questions so that you may immediately test their learning. The approach allows you to organise your own study time. |

### Reading and References

Criminalistics, Richard Saferstein (Pearson) ISBN-13: 978-0133458824

## Course Policies and Student Responsibilities

### (1) General

You are expected to complete all online activities in good time and not fall behind. You must meet all deadlines set for online assessment.

### (2) Absenteeism

The course is entirely online.

## Academic Integrity

Good academic work depends on honesty and ethical behaviour. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honour Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values.

As a student, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the [academic integrity website](#) for more information. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

## Course Instructors

| Instructor     | Office Location | Phone    | Email               |
|----------------|-----------------|----------|---------------------|
| Roderick Bates | CBC04-08        | 63168907 | roderick@ntu.edu.sg |
|                |                 |          |                     |

## Planned Weekly Schedule

| Week | Topic                             | Course LO | Readings/ Activities       |
|------|-----------------------------------|-----------|----------------------------|
| 1    | Introduction to forensic science  | 1         | lecture                    |
| 2    | Atomic and Molecular Spectroscopy | 2         | online interactive content |
| 3    | Time of Death                     | 3         | online interactive content |
| 4    | Blood                             | 4         | online interactive content |
| 5    | Toxicology                        | 5         | online interactive content |
| 6    | case study 1 and peer review 1    | 1-5, 11   | assessment                 |
| 7    | DNA                               | 6         | online interactive content |
| 8    | Drugs, Polymers and fibres        | 7, 8      | online interactive content |
| 9    | Fingerprinting, Firearms,         | 9, 10     | online interactive content |
| 10   | Case Studies                      | 11        | online interactive content |
| 11   | case study 2 and peer review 2    | all       | assessment                 |
| 12   | -                                 | -         | -                          |

|   |   |   |   |
|---|---|---|---|
| 13  | - | - | - |
| The above schedule is for illustrative purposes and is subject to the exigencies of the calendar. Although topics are assigned to specific weeks, hard deadlines will not be implemented. |   |   |   |

## Appendix 1: Assessment Criteria for all components

### case-studies

| <b>Standards</b>  |   |  |
|---|---|--|
| <b>Fail standard<br/>(3-4 marks)</b>  | <b>Pass standard<br/>(5-7 marks)</b>  | <b>High standard<br/>(8-10 marks)</b>  |
| Answers to the questions do not show logical or critical analysis and are often reiteration of lecture content. | Answers to the questions demonstrate logical and critical analysis in most cases. | Answers to the questions demonstrate highly logical and critical analysis of the information provided in the case. |

### peer review

| <b>Standards</b>                                      |   |   |
|---|---|---|
| <b>Fail standard<br/>(3-4 marks)</b>                  | <b>Pass standard<br/>(5-7 marks)</b>  | <b>High standard<br/>(8-10 marks)</b>   |
| Comments are brief and show an absence of engagement. | Comments are reasonable and show sufficient engagement with the submitted work. | Comments are incisive and logical and show critical engagement with the submitted work. |

## CBC Programme Learning Outcome

The Division of Chemistry and Biological Chemistry (CBC) offers an undergraduate degree major in Chemistry that satisfies the American Chemical Society (ACS) curricular guidelines and equips students with knowledge relevant to the industry. Graduates of the Division of Chemistry and Biological Chemistry should have the following key attributes:

### **1. Competence**

Graduates should be well-versed in the foundational and advanced concepts of chemical science, be able to evaluate chemistry-related information critically and independently, and be able to use complex reasoning to solve emergent chemical problems.

### **2. Creativity**

Graduates should be able to synthesize and integrate multiple ideas across the curriculum, and propose innovative solutions to emergent chemistry-related problems based on their training in chemistry.

### **3. Communication**

Graduates should be able to demonstrate clarity of thought, independent thinking, and sound scientific analysis and reasoning through written and oral reports to audiences with varying technical backgrounds. They should also be able to effectively engage other professional chemists in collaborative endeavours.

### **4. Character**

Graduates should be able to act in responsible ways and uphold the high ethical standards that the society expects of professional chemists.

### **5. Civic-mindedness**

Graduates should be aware of the impact of chemistry on society, and how chemistry can be applied to benefit mankind. They should also be aware of and uphold the